

**INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITD&M) KANCHEEPURAM**

Course Title	Advanced Geometric Modelling and CAD	Course No (will be assigned)				
Specialization	Mechanical Engineering	Structure (LTPC)	3	1	0	4
Offered for	PG/Ph.D.	Status	Core <input type="checkbox"/>		Elective <input checked="" type="checkbox"/>	
Faculty	Dr P Pandithevan	Type	New <input type="checkbox"/>		Modification <input checked="" type="checkbox"/>	
Recommendation from the DAC: Yes		Date of DAC	2013			
External Expert(s)	Prof. G. Saravana Kumar, IIT Madras					
Pre-requisite	Computer-Aided Design Fundamentals & Engineering Mathematics	To take effect from	Jan 2021			
Learning Objectives	<ul style="list-style-type: none"> ➤ To make the students to understand the mathematical basis for geometric modeling of curves, surfaces and solids, and their relationship with computer aided design. ➤ To teach the methods of representation of wireframe, surface, and solid modeling systems. ➤ The course also aims at considering the data associativity concepts of CAD/CAE and makes the students to be familiar with collaborative design tools including virtual prototyping. 					
Learning Outcomes	<p>At the end of the course, the students will be able to</p> <ul style="list-style-type: none"> ➤ model and represent three-dimensional surfaces and exchange data from one system to another. ➤ make use of the 3D-solid representation techniques in product development. ➤ handle the data exchange in computer-aided design and manufacturing. 					
Contents of the course (With approximate break up of hours)	<p>Computer graphics fundamentals: Introduction to geometric representation- Implicit, explicit, parametric equations; Transformations in 2D and 3D, projections (L6 + T2)</p> <p>Parametric curves: Differential geometry of curves, Cubic Hermite curves - Algebraic and geometric form, Blending functions, subdivision, reparameterization and composite Hermite curves, continuity aspects, Bezier curves - control polygons and Bernstein basis, de Castel'jau algorithm, continuity aspects, rational Beziers, B-spline curves - periodic, open and non-uniform knot vectors and corresponding curves, rational B-splines, NURBS curve (L10 + T4)</p> <p>Parametric surfaces: Hermite surface - algebraic and geometric form, subdivision and reparameterization, continuity of surfaces, Bezier surface - control net representation, continuity aspects, rational Bezier surfaces, B-Spline surfaces - periodic, open and non-uniform knot vectors and corresponding surfaces, rational B-splines, NURBS surface (L10 + T4)</p> <p>Representation of solids: Topology, Euler and modified form of equations, representations - Quadtree, Octree, Halfspace, Boundary Representation (B-Rep), Constructive Solid Geometry (CSG), Boolean operations in 2D - set membership classification, Union, Difference and Intersection (L10 + T2)</p> <p>Data exchange in CAD/CAM: File formats - Native and neutral formats for contour, surface and Solid, Error handling in CAD, Interfacing with manufacturing systems (L6 + T2)</p>					
Textbook	<ol style="list-style-type: none"> 1. Zeid. I, <i>CAD/CAM Theory and Practice</i>, Tata McGraw Hill, 2006. 2. Rogers. D.F and Adams, J.A, <i>Mathematical Elements for Computer Graphics</i>, McGraw Hill, 2002. 3. M. E. Mortenson, <i>Geometric Modeling</i>, John Wiley & Sons, 1985. 					
References	<ol style="list-style-type: none"> 1. Gerald E. Farin, <i>Curves and Surfaces for CAGD</i>, Morgan Kaufmann, 2002. 2. Rogers. D.F, <i>An Introduction to NURBS</i>, Morgan Kaufmann, 2001. 3. M. E. Mortenson, <i>Mathematics for Computer Graphics Applications</i>, 2nd ed., Industrial Press, 1999. 4. Hoschek. J and Lasser. D, <i>Computer Aided Geometric Design</i>, AK Peters, 1996. 					